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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/586,540	07/19/2006	Susumu Kayama	Q79610	1641

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EXAMINER

TAI, XIUYU

ART UNIT	PAPER NUMBER
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1795

NOTIFICATION DATE	DELIVERY MODE
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04/28/2010

ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary	Application No. 10/586,540	Applicant(s) KAYAMA ET AL.	
	Examiner Xiuyu Tai	Art Unit 1795	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 25 January 2010.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-68 is/are pending in the application.
- 4a) Of the above claim(s) 5,9-23 and 33-68 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-4,6-8 and 24-32 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>7/19/2006 & 10/20/2006</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Election/Restrictions

1. Claims 5, 9-23, 33-68 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected invention, there being no allowable generic or linking claim. Election was made **without** traverse in the reply filed on 1/25/2010. Claims 1-4, 6-8, and 24-32 (Group I and species A1) will be examined on the merits.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. Claims 6, 8, 24, 28, 2930, rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

4. Claim 6 recites limitations of "a metal oxide powder having ... (herein refereed to as Particles Group A)" in line 2 and "a metal oxide powder having ... (herein refereed to as Particles Group B)" in line 4. It is not clear if "a metal oxide powder ... (...Particle Group A)" and "a metal oxide powder ... (...Particle Group B)" are the same/different powders. In addition, it is not clear if the limitations in parentheses (i.e. (hereafter refereed to as Particle Group A) and (hereafter referred to as Particle Group B)) are positively cited in the claim. Therefore, appropriate clarification is required. For the purpose of examination, the claim will be interpreted as the metal oxide particles comprise a metal oxide powder having Particle Group A with an average primary

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particle diameter of 100 nm to 1 um and another metal oxide powder having Particle Group B having an average primary particle diameter of 5 to 40 nm.

5. Claim 8 recites limitations of "a metal oxide powder having ... (herein refereed to as Particles Group C)" in line 2 and "a metal oxide powder having ... (herein refereed to as Particles Group D)" in line 4. It is not clear if "a metal oxide powder ... (...Particle Group C)" and "a metal oxide powder ... (...Particle Group D)" are the same/different powders. Furthermore, the claim language does not distinguish "a metal oxide powder" from claim 6. In addition, it is not clear if the limitations in parentheses (i.e. (hereafter refereed to as Particle Group C) and (hereafter referred to as Particle Group D)) are positively cited in the claim. Therefore, appropriate clarification is required. For the purpose of examination, the claim will be interpreted as wherein Particle Group B is a mixture of metal oxide powders comprising Particle Group C with an average primary particle diameter of 20 to 40 nm and Particle Group D with an average primary particle diameter of 5 to 20 nm.

6. Claim 24 recites the limitation "the titanium dioxide" in line 2. There is insufficient antecedent basis for this limitation in the claim. Therefore, appropriate correction is required. For the purpose of examination, "the titanium dioxide" is interpreted as "the metal oxide".

7. Claims 28 and 30 recite the limitation "the binder" in line 1. There is insufficient antecedent basis for this limitation in the claim. Therefore, appropriate correction is required. For the purpose of examination, it is assumed that claims 28 and 30 depend upon claim 27 where "a binder" is cited.

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8. Claim 29 recites the limitation “the monomer unit” in line 1. There is insufficient antecedent basis for this limitation in the claim. Therefore, appropriate correction is required.

Claim Rejections - 35 USC § 102

9. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

10. Claims 1-3, 24-29, and 32 are rejected under 35 U.S.C. 102(b) as being anticipated by Murofushi et al (WO 02/067357)

11. Regarding claim 1, Murofushi et al disclose a metal oxide dispersion for a dye-sensitized solar cell (ABSTRACT). The metal oxide dispersion comprises metal oxide particles and a solvent (paragraph [0014]). The reference further the metal oxide is titanium oxide which is produced by a gas phase method (paragraphs [0014] & [0021]). As indicated by the instant specification, titanium oxide produced by a gas phase method has a necking structure (see page 19). Therefore, the titanium oxide of Murofushi inherently has a necking structure. The contact angle of the metal oxide dispersion to an ITO film is considered as a property of the metal oxide. Since the metal oxide dispersion of Murofushi is substantially the same as the claimed metal oxide, the disclosed metal oxide dispersion inherently has the claimed property.

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12. Regarding claim 2, Murofushi teaches that a transparent resin electrode (ITO on polyethylene terephthalate) is made by coating the metal oxide dispersion thereon (Examples 1 & 6),

13. Regarding claim 3, the reference teaches that the solvent used in the dispersion may contain water and ethanol (paragraph [0042]).

14. Regarding claim 24, the reference teaches that the metal oxide is a titanium oxide (paragraphs [0014] & [0021]). The optical band gap is considered as a composition-related property. Since the metal oxide of Murofushi is substantially the same as the claimed metal oxide, the disclosed metal oxide inherently has the claimed band gap and property.

15. Regarding claim 25, the reference also teaches that the metal oxide can be mixtures of two or more metal oxides, such as titanium oxide and zinc oxide (paragraph [0019]).

16. Regarding claim 26, Murofushi teaches that the amount of the metal oxide is from 10-40% mass (paragraph [0020]).

17. Regarding claim 27, the reference teaches that the metal oxide dispersion contains a binder (paragraph [0014] & [0041]) and the amount of binder is from 0.01 to 20 mass parts per 100 mass parts of the metal oxide fine particles.

18. Regarding claim 28, the binder of Murofushi may include poly(N-vinylacetamide) (paragraph [0041]), which is a water-soluble polymer.

19. Regarding claim 29, the binder of Murofushi may include poly(N-vinylacetamide) (paragraph [0041] & claim 4).

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20. Regarding claim 32, Murofushi teaches that an electrode is made by coating the metal dispersion on a sheet-shaped electrode (ABSTRACT, Examples 1 & 6).

Claim Rejections - 35 USC § 103

21. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

22. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

23. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

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24. Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Murofushi et al (WO 02/067357) as applied to claim 1 above.

25. Regarding claim 4, Murofushi teaches that the solvent used in the dispersion may contain water and ethanol (paragraph [0042]), but does not specifically teach the claimed amount of ethanol. However, Murofushi indicates that the metal oxide dispersion containing ethanol is used to make an electrode by evaporating the solvent which contains ethanol (paragraph [0014]) and the solvent is also used to promote dispersing and dissolving (paragraph [0040]). One having ordinary skill in the art would have known that more ethanol results in quicker evaporation of the solvent while sufficient amount of ethanol is required for better dispersing and dissolving of metal oxide. Therefore, one having ordinary skill in the art would have realized to optimize the amount of ethanol in order to achieve quicker evaporation of solvent and better dispersing and dissolving of metal oxide.

26. Claims 6 and 7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Murofushi et al (WO 02/067357) as applied to claim 6 above, and further in view of Wantanabe et al (EP 1271581) .

27. Regarding claim 6, Murofushi teaches that the metal oxide may contain two different particle sizes of titanium oxide (i.e. titanium oxide A & B) in combination (paragraph [0040] & Examples 8 & 9), but does not specifically disclose the claimed particles sizes. However, Wantanabe et al disclose a dye-sensitized solar cell. Wantanabe teaches that the semiconductor layer of a dye-sensitized solar cell may contain (i) smaller particles with the particle size 25 nm or less for providing sufficient

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surface area and (ii) large particles with the particle size 100-300 nm for scattering light (paragraph [0074]). Therefore, it would be obvious for one having ordinary skill in the art to utilize the larger particles with particle size of 100-300 nm and the small particle with the particle size less than 25 nm as suggested by Wantanabe in order to improve light capturing rate and provide sufficient surface area for the dye, hence enhancing the efficiency of Murofushi

28. Regarding claim 7, Murofushi teaches that the amount of the metal oxide is from 10-40% mass (paragraph [0020]).

29. Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Murofushi et al (WO 02/067357) and Wantanabe et al (EP 1271581) as applied to claim 6 above, and further in view of Koyanagi et al (U.S. 6,849,797).

30. Regarding claim 30, Murofushi/Wantanabe does not teach the small particles containing two different particle sizes. However, Koyanagi et al disclose a dye-sensitized solar cell (ABSTRACT). Koyanagi teaches that the particle diameter of TiO₂ in the semiconductor film of a dye-sensitized solar cell is preferably in the range of 5-30 nm (col. 10, line 18-20). Koyanagi further indicates that on one hand, small particles may result in decreased electron mobility even though they may increase surface area for absorbing the dye; on the other hand, large particles may reduce the adsorption amount of the dye, hence decreasing the efficiency (col. 10, line 28-32). Therefore, one having ordinary skill in the art would have realized to include small particles and large particles of TiO₂ in the small particles of Murofushi/Wantanabe as suggested by Koyanagi in order to ensure sufficient amount of the dye being absorbed onto TiO₂

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particles while achieving maximum electron transfer within the TiO₂ film of Murofushi/Wantanabe.

Moreover, the particle size of Koyanagi is within the range of Particle B of Murofushi, but Murofushi/Wantanabe/Koyanagi does not specifically disclose the claimed particle sizes in two groups. However, one having ordinary skill in the art would have realized to optimize small particle range and large particle range in order to ensure sufficient amount of the dye being absorbed onto TiO₂ particles while achieving maximum electron transfer within the TiO₂ film of Murofushi/Koyanagi.

31. Claim 30 is rejected under 35 U.S.C. 103(a) as being unpatentable over Murofushi et al (WO 02/067357) as applied to claim 1 above, and further in view of Tanaka et al (PG-PUB US 2003/0162016).

32. Regarding claim 30, Murofushi does not teach a zirconium compound as a binder. However, Tanaka et al disclose an ultrafine mixed crystal oxide. Tanaka teaches that zirconium compound is known an inorganic binder (paragraph [0069]). The teaching of Tanaka shows that zirconium compound is an equivalent binder. Therefore, one having ordinary skill in the art would have found it obvious to substitute zirconium compound for the polymer binder because they are art-recognized equivalent.

33. Claim 31 is rejected under 35 U.S.C. 103(a) as being unpatentable over Murofushi et al (WO 02/067357)

34. Regarding claim 31, Murofushi et al disclose a metal oxide dispersion for a dye-sensitized solar cell (ABSTRACT). Murofushi teaches that the metal oxide dispersion can be coated on a transparent resin electrode (i.e. a transparent electrically conducting

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resin substrate, Examples 1 & 6, paragraph [0063]) to form an electrode. A dye-sensitized solar cell is prepared by absorbing ruthenium complex dye $\text{RuL}_2(\text{NCS})_2$ (i.e. N3 dye) onto the resulting electrode (paragraph [0063]), superposing a counter electrode having platinum on another glass electrode (paragraph [0063]), and injecting lithium iodide electrolyte (i.e. iodine based electrolyte) between the counter electrode and the resulting electrode (paragraph [0063]). Murofushi also teaches that the glass electrode can be constructed with a FTO film on a glass (i.e. an FTO transparent electrically conducting glass, col. 14, line 66-67); as a result, the counter electrode has platinum on a FTO glass.

The covered area of the dye electrode of Murofushi is 5x5 mm (col. 15, line 8). Murofushi does not specifically teach the resulting electrode having an area of 1 cm². However, it is known in the art that the output of a solar cell increases with the area of the dye electrode. Therefore, it would be obvious for one having ordinary skill in the art to increase the area of the electrode in order to increase the output of the solar cell of Murofushi.

Since the modified solar cell of Murofushi is substantially the same as the claim solar cell, the modified solar cell of Murofushi is fully capable of performing the claimed functions.

It should be noted that the claim contains product (film) by process (formed at 150C) language. Forming the film (or coating) at 150C does not impart any unexpected significant properties to the solar cell. Therefore, the claimed product produced by forming the coating at 150C appears to have similar characteristics as the disclosed

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product. Because of the nature of product-by-process claims, the Examiner cannot ordinarily focus on the precise difference between the claimed product and the disclosed product. It is then Applicants' burden to prove that an unobvious difference exists. See *In re Marosi*, 218 USPQ 289,292-293 (CAFC 1983).

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Xiuyu Tai whose telephone number is 571-270-1855. The examiner can normally be reached on Monday - Friday, 7:30 AM - 5:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Alexa Neckel can be reached on 571-272-1446. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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/X. T./

Examiner, Art Unit 1795

/Alexa D. Neckel/

Supervisory Patent Examiner, Art Unit 1795